

WHAT IS CLAIMED IS:

1. A rotary seal member for forming a seal in a hydraulic rotary swivel, said hydraulic rotary swivel including a first part and a second part rotatable relative to each other in at least one direction and said first part and said second part each having a surface, said surface of said first part opposing the surface of said second part at an interface therebetween, said opposing surfaces of said first and second parts being separated by a gap, said rotary seal member comprising:

(a) an elongated annular body forming a closed ring and being positioned at said interface and extending into said gap between said first part and said second part to ~~provide a seal between said first part and said second part, said elongated body being~~ adapted to be retained in a corresponding annular shaped retaining groove formed in said surface of one of said first part and said second part to engage at said interface said opposing surface of the other of said first part and said second part so as to provide said seal;

(b) at least one protuberance formed on said elongate body, said at least one protuberance being adapted to fit within a corresponding depression formed in a surface of said one of said first part and said second part,

wherein, during operation of said rotary swivel to rotate said first part and said second part relative to each other, the interaction of said at least one protuberance and said corresponding depression assists in substantially preventing rotation of said elongated body relative to said annular retaining groove in at least one direction.

2. The rotary seal member of claim 1, wherein said corresponding depression is formed along a surface of said retaining groove.

3. The rotary seal member of claim 1, wherein said elongated body forming said ring further includes an energizer member receiving surface and a sealing surface.

4. The rotary seal member of claim 1, wherein said elongate body of said rotary seal member has first and second sides, and at least one protuberance extends laterally from at least one of said first and second sides.

5. The rotary seal member of claim 4, wherein said elongate body forming said ring further includes an energizer member receiving surface and a sealing surface.

6. The rotary seal member of claim 5, wherein said energizer member receiving surface of said elongate body is adapted to receive an energizer member placed in said retaining groove.

7. The rotary seal member of claim 6, wherein said sealing surface of said elongate body is adapted to slideably contact said opposing surface formed by the other of said first part and said second part.

8. The rotary seal member of claim 7, wherein said at least one protuberance and said corresponding depression cooperate to retain said rotary seal member in said retaining groove in stationary contact with said energizer member.

9. The rotary seal member of claim 8, wherein said energizer member is a resiliently deformable o-ring.

10. The rotary seal member of claim 5, wherein said at least one protuberance extending laterally from at least one of said first and second sides is less than the thickness of said rotary seal member.

11. The rotary seal member of claim 10, wherein said at least one protuberance is adjacent said sealing surface.

12. The rotary seal member of claim 1, wherein said elongate body has a plurality of protuberances formed thereon, and said retaining groove has corresponding depressions.

13. The rotary seal member of claim 12, wherein said plurality of protuberances are substantially evenly spaced on said elongate body.

14. The rotary seal member of claim 1 wherein one of said first part and said second is a cylinder member located within and which is encircled by the other of said first part and second part, and said other part is an outer housing surrounding said inner cylinder.

15. The rotary seal member of claim 1 wherein one of said first part and said second is a first cylinder member having a generally flat annular end surface and having said annular groove formed therein, and wherein the other of said first part and said second part is a second cylinder member having a generally flat annular end surface, said first and second cylinders being in longitudinal alignment such that said annular end surfaces of said first and second cylinders form said opposing surfaces at said interface.

16. The rotary seal member as claimed in claim 1 wherein said at least one protuberance and said corresponding depression are configured to prevent rotation of said elongated body in said at least one direction and in an opposite direction.

17. A rotary seal assembly for a hydraulic rotary swivel, said hydraulic rotary swivel including a first part and a second part rotatable relative to each other in at least one direction and said first part and said second part each having a surface, said surface of said first part opposing the surface of said second part at an interface therebetween, said opposing surfaces of said first and second parts being separated by a gap, said rotary seal assembly comprising:

~~(a) an annular rotary seal member comprising an elongate body forming a~~
closed ring and being positioned at said interface in between said first part and said second part to provide a seal, said elongate body having at least one protuberance formed thereon;

(b) an annular retaining groove formed in one of said first part and said second part, said retaining groove being adapted to receive said rotary seal member therein, said retaining groove being formed in one of said first part and said second part to engage an opposing surface formed by the other of said first part and said second part at said interface, said one of said first part and said second part having at least one depression corresponding to and cooperating with said at least one protuberance such that, during operation of said rotary swivel, the interaction of said at least one protuberance and said corresponding depression assists in substantially preventing rotation in at least one direction of said rotary seal member in said annular retaining groove.

18. The rotary seal assembly of claim 17, wherein said elongate body of said rotary seal member has first and second sides, and at least one protuberance extends laterally from at least one of said first and second sides.

19. The rotary seal assembly of claim 17, further comprising an energizer member suitably sized and shaped to be placed in said retaining groove, and suitably sized and shaped to be received on an energizer member receiving surface on said rotary seal member.

20. The rotary seal assembly of claim 19, wherein said energizer member is suitably ~~adapted to urge, in use, said rotary seal member against an opposing sealing surface~~ formed by one of said outer surface of said inner cylinder and said inner surface of said outer housing.

21. The rotary seal assembly of claim 20, wherein said energizer member is made of nitrile.

22. The rotary seal assembly of claim 17, wherein said rotary seal member has a plurality of protuberances formed thereon, and said retaining groove has corresponding depressions formed therein.

23. The rotary seal assembly of claim 22, wherein said plurality of protuberances are substantially evenly spaced on said rotary seal member.

24. The rotary seal assembly of claim 17, wherein said first part is an inner cylinder and said second is an outer housing, said inner cylinder and said outer housing having a substantially cylindrical interface and a common central axis of rotation.

25. The rotary seal assembly of claim 17 wherein one of said first part and said second is a cylinder member located within and which is encircled by the other of said first part and second part, and said other part is an outer housing surrounding said inner cylinder.

26. The rotary seal assembly of claim 25 wherein said first part and said second part ~~are rotatable relative to each other about longitudinal axes which are parallel to each~~
other.

27. The rotary seal assembly of claim 26 wherein said first part and said second part are rotatable about a common longitudinal axis.

28. The rotary seal assembly of claim 17 wherein said first part and said second part are rotatable relative to each other about longitudinal axes which are parallel to each other.

29. The rotary seal assembly of claim 28 wherein said first part and said second part have a common longitudinal axis of rotation.

30. The rotary seal assembly of claim 29 wherein said outer housing is fixed to a frame and said inner cylinder rotates relative to said outer housing.

31. The rotary seal assembly as claimed in claim 17 wherein said at least one protuberance and said corresponding depression are configured to prevent rotation of said elongated body in said at least one direction and in an opposite direction.

32. The rotary seal assembly of claim 17 wherein one of said first part and said second is a first cylinder member having a generally flat annular end surface and having said annular groove formed therein, and wherein the other of said first part and said second part is a second cylinder member having a generally flat annular end surface, said first and second cylinders being in longitudinal alignment such that said annular end surfaces of said first and second cylinders form said opposing surfaces at said interface.

33. A hydraulic rotary swivel, said hydraulic rotary swivel including a first part and a second part rotatable relative to each other in at least one direction and said first part and said second part each having a surface, said surface of said first part opposing the surface of said second part at an interface therebetween, said opposing surfaces of said first and second parts being separated by a gap, said hydraulic rotary swivel including:

at least one rotary seal assembly, each rotary seal assembly comprising:

(a) an annular rotary seal member comprising an elongate body forming a closed ring and being positioned at said interface in between said first part and said second part to provide a seal, said elongate body having at least one protuberance formed thereon;

(b) an annular retaining groove formed in one of said first part and said second part, said retaining groove being adapted to receive said rotary seal member therein, said one of said first part and said second part having at least one depression corresponding to

and cooperating with said at least one protuberance such that, during operation of said rotary swivel, the interaction of said at least one protuberance and said corresponding depression assists in preventing rotation of said rotary seal member said annular retaining groove in at least one direction.

34. The hydraulic rotary swivel of claim 33, further comprising first and second rotary seal assemblies and wherein said first and second rotary seal assemblies define a sealed compartment between said first part and said second part.

35. The hydraulic rotary swivel of claim 34, wherein said rotary seal member has an elongate body forming a ring, said elongate body having first and second sides, and said at least one protuberance extends laterally from at least one of said first and second sides.

36. The hydraulic rotary swivel of claim 35, wherein said rotary seal member further includes an energizer member receiving surface and a sealing surface.

37. The hydraulic rotary swivel of claim 36, wherein said energizer member receiving surface of said elongate body is adapted to receive an energizer member fitted into said retaining groove.

38. The hydraulic rotary swivel of claim 37, wherein said sealing surface of said elongate body is adapted to slideably contact an opposing sealing surface formed by the other of said first part and said second part.

39. The hydraulic rotary swivel of claim 33, wherein said elongate body has a plurality of protuberances formed thereon, and said retaining groove has corresponding depressions formed therein.

40. The hydraulic rotary swivel of claim 39, wherein said plurality of protuberances are substantially evenly spaced on said elongate body.

41. The hydraulic rotary swivel of claim 33, wherein said first part is an inner cylinder and said second is an outer housing, said inner cylinder and said outer housing having a substantially cylindrical interface and a common central axis of rotation.

42. The hydraulic rotary swivel of claim 33 wherein one of said first part and said second is a cylinder member housed within and which encircles the other of said first part and second part, and said other part is an outer housing surrounding said inner cylinder.

43. The hydraulic rotary swivel of claim 33 wherein one of said first part and said second is a first cylinder member having a generally flat annular end surface and having said annular groove formed therein, and wherein the other of said first part and said second part is a second cylinder member having a generally flat annular end surface, said first and second cylinders being in longitudinal alignment such that said annular end surfaces of said first and second cylinders form said opposing surfaces at said interface.

44. The hydraulic rotary swivel as claimed in claim 33 wherein said first part and said second part rotate relative to each other in said at least one direction and in an opposite direction wherein said at least one protuberance and said corresponding depression are

configured to prevent rotation of said elongated body in said at least one direction and in an opposite direction.

45. A method of adapting a retaining groove in a hydraulic rotary swivel to receive a rotary seal member, said hydraulic rotary swivel including a first part and a second part rotatable relative to each other and having a common interface, said rotary seal member being positioned at said interface in between said first part and said second part to provide a seal, said retaining groove being formed in one of said first part and said second part and being adapted to receive said rotary seal member therein, said method comprising:

(i) identifying the size, shape and position of a protuberance provided on said rotary seal member;

(ii) for each said protuberance identified in (i), forming a corresponding depression along said retaining groove, each said depression corresponding in size, shape and position to said protuberance.

46. The method of claim 45, wherein two depressions are formed by a single machining operation, said depressions being formed on either side of said retaining groove and being adapted to receive corresponding protuberances provided on said rotary seal member.

47. The method of claim 46, wherein one depression is formed by a single machining operation on one side of said retaining groove, each said depression being adapted to receive a corresponding protuberance provided on said rotary seal member.

48. A method of forming a rotary seal assembly for a hydraulic rotary swivel, said hydraulic rotary swivel including a first part and a second part rotatable relative to each other and having a common interface, said method comprising:

(i) forming a retaining groove in one of said first part and said second part at said interface, said retaining groove being adapted to receive a corresponding rotary seal member therein and to position said rotary seal member at said interface in between said first part and said second part to provide a seal;

(ii) forming in said retaining groove at least one depression corresponding to at least one protuberance provided on said rotary seal member;

(iii) fitting said corresponding rotary seal member in said retaining groove such that said at least one depression and said at least one protuberance are coupled,

such that, during operation of said rotary swivel, the interaction of said at least one protuberance and said corresponding depression assists in retaining said rotary seal member in a substantially stationary position relative to said retaining groove.

49. The method of claim 48, further comprising:

(iv) placing an energizing member in said retaining groove beneath said rotary seal member, such that said retaining groove urges said rotary seal member against an opposing sealing surface formed by the other of said first part and said second part.